Dr Marius Somveille

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Research Interests

- Understanding why and how species distribute on Earth.
- Investigating the movement patterns of mobile organisms and in particular the regular, seasonal movements of migratory species.
- Analysing large sets of ecological and distributional data using spatially-explicit models.
- Developing mechanistic models based on first ecological and energetic principles, which can be used to make ecological predictions and forecasts to inform future conservation actions
- Modelling the spread of propagules on animal movement networks.

Professional Appointments

Postdoctoral Researcher, *2017–now*
Max Planck Yale Center for Biodiversity Movement and Global Change, Yale University.

Research Associate, *2017–now*
University of Oxford, Department of Zoology.

Postdoctoral Research Fellow, *2015–2017*
University of Oxford, Edward Grey Institute & Biodiversity Institute, Department of Zoology.

Education

PhD in Ecology, *2011–2015*
University of Cambridge, Department of Zoology and Gonville & Caius College.
Supervisors: Andrea Manica (University of Cambridge, UK) and Ana Rodrigues (CNRS, France)

Masters in Ecology, Biodiversity and Evolution, *2009–2011*
University of Paris-Sud. Awarded with distinction (*mention Bien*).

Magistère in Biotechnology and Entrepreneurship, *2009–2011*
University of Paris-Sud. A program of excellence (pursued in combination with my Masters degree) combining science, entrepreneurship and research training. Awarded with distinction (*mention Bien*).

Bachelor in Biological Sciences, *2006–2009*
University of Paris-Sud. A three-year undergraduate degree. Included a semester abroad at the University of North Carolina at Chapel Hill (2008) as part of the Trans-Atlantic Science Student Exchange Program (TASSEP). Awarded with distinction.

Publications

- **Somveille M**, Rodrigues ASL, Manica A (2018) Energy efficiency drives the global seasonal distributions of birds. *Nature Ecology & Evolution.* [Media coverage: The Washington Post, Quanta Magazine, Forbes, Agence France Press]

This study addresses a long-standing question in ecology – what drives the distribution of biodiversity on Earth – in a novel way. Using bird migration as a natural experiment and a mechanistic model of the seasonal geographical distribution of terrestrial bird species, we show for the first time that birds distribute across the world in the most energy-efficient way. We provide strong evidence that bird species appear to minimise the energy used for survival while targeting areas with maximum energy available, considering the distributional strategies of all the other species, with migration allowing species to further optimise energy budget in the face of seasonality and competition. This study has far reaching implications for understanding the global distribution of biodiversity

- Somveille M, Manica A, Rodrigues ASL (2018) Where the wild birds go: explaining the differences in migratory destinations across terrestrial bird species. *Ecography*

We used null models of seasonal species distributions to show that species' contemporary migratory destinations are such that they allow them to track a temperature regime throughout the year (but not habitat), to escape local competition and reach areas with better access to resources, and to minimize the spatial distance travelled, within the limitations imposed by the geographical location of each species.

- Somveille M, Firth JA, Aplin LM, Farine DR, Sheldon BC, Thompson RN (2018) Movement and conformity interact to establish local behavioural traditions in animal populations. *bioRxiv*. doi.org/1.1101/338657.

We developed a spatially-explicit model of the spread of behavioural preferences in a population, which can replicate a real-world cultural diffusion experiment. Our results revealed a key interplay between ecological and social processes (in this case, movement and conformist learning) for determining whether or not traditions establish in a population, which opens up new paths to study animal culture.

- Revell C & **Somveille M** (2017) A Physics-inspired mechanistic model of migratory movement patterns in birds. *Scientific Reports* 7:9870. [#28 most accessed out of >1500 Ecology paper in 2017]

Collaborating with a physicist, we developed an individual-based mechanistic model of migratory movement patterns, combining data on wind velocity and food density to produce an environmental potential landscape that accurately predicts migration patterns for several seabird population.

- Somveille M (2016) The global ecology of bird migration: patterns and processes. *Frontiers of Biogeography* 8:e32694 – This paper is a detailed synopsis of my PhD research.

- Somveille M, Marshall K, Gluckman T-L (2016) A global analysis of bird plumage patterns reveals no association between habitat and camouflage. *PeerJ* 4:2658.

Using a global dataset on avian plumage patterns and phylogenetic comparative analyses, we tested for the first time for an association between habitat and plumage patterns across the world's birds, but found no evidence for it as well as little phylogenetic signal.

- Somveille M, Rodrigues ASL, Manica A (2015) Why do birds migrate? A macroecological perspective. *Global Ecology and Biogeography* 24: 664-674.

In this study, we used statistical models to investigate the effect of various environmental predictors on the global diversity patterns associated with bird migration, and found strong support for the hypotheses that migratory birds move to their breeding grounds to exploit a seasonal surplus in energy and resources and avoid competition from residents, and then redistribute to the nearest suitable non-breeding grounds.

- Feeney WE, Medina I, **Somveille M**, *et al.* (2013) Brood parasitism and the evolution of cooperative breeding in birds. *Science* 342(6165): 1506-1508. [Media: National Geographic, Global Times]

This study found that reciprocally selected interactions may explain the strong association between brood parasitism and cooperative breeding in birds, opening up new research avenues for the field.

- Somveille M, Manica A, Butchart SHM, Rodrigues ASL (2013) Mapping global diversity patterns for migratory birds. *PLoS ONE* 8: e70907.

This paper shows the first maps of the global diversity patterns associated with bird migration and found that despite the great biological and ecological diversity in migratory birds, strong spatial patterns emerge when all species are pooled together.

Research experience & specialised training

Postdoctoral Research. *Since 2015 – University of Oxford, Yale University & Max Planck Institute for Ornithology.* Development of mechanistic models of (1) bird migration at global- and individual-level, and (2) spatio-temporal spread of novel feeding behaviours at population-level.

Complex Systems Summer School. *June 2016 – Santa Fe Institute (USA).* Four-weeks

interdisciplinary course providing background and training to analyse complex adaptive systems.

PhD Research. *2011-2015 – University of Cambridge*. Analysis of the global bird migratory system to investigate the processes underlying observed spatial patterns. Included: spatial analyses of species distributions and environmental datasets, multivariate spatial statistical analyses, simulation of species ranges, development of a mechanistic model of global bird migration.

International PhD short course: modelling species distributions under climate change. *August 2012 – Center for Macroecology, Evolution and Climate in Copenhagen, Denmark.* Course covering theoretical and methodological training in species distribution models and predictions.

MSc research. *Feb-July 2011 – CNRS Center for Functional and Evolutionary Ecology in Montpellier, France*. Analysis of the spatial patterns of the global bird migratory system.

MSc research. *June-Sept 2010 – University of Cambridge, Department of Zoology.* Analysis of large genetic variation datasets and development of a population genetics model to investigate the origin of domestication and historical expansion of the European Taurine Cattle.

MSc research. *March-June 2010 – CNRS Laboratory Evolution, Genome, Speciation (France).* Designed multi-generations experiments on laboratory Drosphilae populations, and performed RNA extraction and RT-qPCR, to study variations in transposable elements expression under stress.

Grants and Awards

2017 Lockey research and travel grant. *University of Oxford.*

2017 Linacre travel grant. *University of Oxford*.

2016 **Junior Research Fellowship.** *Linacre College, University of Oxford*. This non-stipendiary fellowship offered me the opportunity to participate in College life in Oxford, interacting with a diverse group of scholars across academic disciplines and enjoying the College facilities.

2015 **Edward Grey Institute Postdoctoral Fellowship.** *University of Oxford.* Independent research fellowship, 2 years salary.

2014 Gonville & Caius College Travel Grant III. *University of Cambridge.*

2013 **Research Studentship**. *Cambridge Philosophical Society*, *University of Cambridge.*

2013 Gonville & Caius College Travel Grant II. *University of Cambridge.*

2013 Work Away Grant II. *University of Cambridge*. For collaborative work with the Center for Functional and Evolutionary Ecology in Montpellier, France.

2012 Gonville & Caius College Travel Grant I. *University of Cambridge.*

2012 Work Away Grant I. *University of Cambridge*. For collaborative work with the Center for Functional and Evolutionary Ecology in Montpellier, France.

2012 **Entente Cordiale Scholarship.** *British Council & French Embassy in the UK.* A prestigious bi-lateral awards scheme that funds French postgraduate students studying in the UK.

2011 Hitchcock Fund Small Grant. *University of Cambridge.*

2008 Trans-Atlantic Science Student Exchange Program, *University of Paris-Sud.* Awarded for a semester abroad as a student at the University of North Carolina at Chapel Hill (USA).

Invited Seminars

2018 Movement Ecology seminar series, CNRS, Montpellier, France.

2018 Biodiversity and Global Change seminar series, Yale University, USA

2018 Max Planck Institute for Ornithology seminar, Radolfzell, Germany.

2017 University of Queensland, School of Biological Sciences, Brisbane, Australia.

2016 Center for Interdisciplinary Research in Biology, Collège de France, Paris, France.

2015 Center for Functional and Evolutionary Ecology seminar, Montpellier, France.

2013 Gonville & Caius College, University of Cambridge, UK.

Oral Presentations at International Conferences

2018 International Biogeography Society Meeting, Evora, Portugal

2017 BES Macro Meeting, British Ecological Society, London, UK.

2017 8th Biennial Meeting of the International Biogeography Society, Tucson, Arizona, USA.

2016 SFécologie2016, Societé Française d'Ecologie, Marseille, France.

2014 Joint meeting of the Societé Française d'Ecologie and British Ecological Society. Lille, France.

2014 10th Ecology and Behaviour Conference. Montpellier, France.

2013 International Congress of Ecology (INTECOL), International Association for Ecology, London.

2013 7th Annual Meeting of the Macroecology Group, German Ecological Society, Göttingen.

2012 6th Annual Meeting of the Macroecology Group, German Ecological Society. Frankfurt.

Teaching Experience

Teaching assistant: EEB 713 – Concepts and methods in biodiversity research. *Yale. 2018.*
Class of postgraduate students. 25 students. Lecture plus a workshop on modelling animal migration.

Demonstrator: Quantitative Methods for Biologists. *University of Oxford. 2016.*
Class of second-year undergraduates. 24 students, 2 hours/week.

Teaching assistant: Population Biology. *University of Cambridge. 2012–2013.*
Weekly supervisions of 3rd year undergraduates. 18 students, 4 hours/week.

Demonstrator: Introduction to R. *University of Cambridge. 2013.*
Workshop at the Student Conference on Conservation Science. 15 students, 16 hours.

Teaching assistant: Behavioural Ecology. *University of Cambridge. 2012.*
Weekly supervisions of 3rd year undergraduates. 4 students, 2 hours/week.

Private tutor: Mathematics. *Employed by Complétude, France. 2009–2010.*
High-school students. 3 students, 6 hours/week.

Evaluation of scientific work and other collective responsibilities

Reviewed scientific papers for Science, Global Ecology and Biogeography, Ecography, Scientific Reports, Journal of Animal Ecology, Functional Ecology.

Main organiser of the Ecology Seminar Series, University of Cambridge, Zoology. *2013–2014*

Team leader for posters, organising committee of the Cambridge Student Conference in Conservation Science – an interdisciplinary conference attracting students from around the world. *2013, 2014, 2015*

Environmental officer, Gonville & Caius College, Cambridge. *2013–2014.* Set up multiple initiatives and events to make the College more environmentally friendly.

Relevant Technical Skills

Programming languages: R, Python, Julia, Matlab. Some of my code can be found on my github page: https://github.com/msomveille. Experience using computing clusters.

Spatial analysis, ArcGIS, ArcPy, R packages (e.g. sp, rgdal, maptools, raster, geosphere).

Languages

French: mother tongue. **English**: fluent in oral, reading and writing. **Spanish**: intermediate knowledge.